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(54) Übertragungssystem zwischen Haupteinheit und zusätzlichen Prozesseinheiten.

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(54) **System for communication between a master and slave processing units.**

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IEE PROCEEDINGS vol. 133, no. 6, November 1986, GREAT BRITAIN pages 312 - 318PARISH AND LUCAS 'ADVANCED AUTOMOTIVE MULTIPLEXED WIRING SYSTEM'

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Description

This invention relates to a communication system of the multiplex type, that is with an information channel which is accessible to a plurality of users, provided between a master processing unit and slave units with the possibility that information exchange can be initiated from one of the slave units. In particular the communication system according to this invention can be applied to a plurality of units associated with the electrical devices in a vehicle, and especially for activation and control of the electrical devices fitted to a vehicle door, such as for example the window winding device, the door locking device, the device actuating various electrical components in an outside rear-view mirror and the manual control switch device for operating the components of the various abovementioned devices as described in Italian patent application no. 67158-A/89 filed on the 7 March 1989 entitled: "Activation and control system for a plurality of electrical devices in a vehicle", and corresponding to WO-A-90/10559.

As is known, multimaster systems in which each unit has the characteristics of a master unit and is therefore capable of communicating directly with every other unit are used in communication systems between various units. This has disadvantages in that:

- all the units must be of approximately equal complexity,
- because all the units are connected by means of a single data transmission line a fault in the latter may cause failure of the entire system if redundancy is not provided, but this entails costly duplication and operational difficulties,
- the structure of the messages is complex, either because they have to include double addressing, or because of the need to interpret all messages by a single unit.

Master-slave systems have therefore been constructed in which there is a central master unit which controls all communication sending commands to, interrogating or synchronising the slave units, which in turn can only transmit after these communications have been received. A result of this however is that the master unit must always be active whenever communication is required with any slave unit, In order to overcome this disadvantage while maintaining the structure of the master-slave system additional transmission lines dedicated to communication requests are required.

A communication system with an hybrid architecture is disclosed in EP-A-0 307 344, of the multi-master type, wherein the master units are connected to each other by a single communication bus, and each master unit is connected to a plurality of slave units through an own line. Each interface is connected to a plurality of electrical devices though an own line. Each master unit controls traffic of communication data by means of cyclic interrogation according to a preset sequence, and in case of critical data to be transmitted from a particular interface, such an interface unit may send, at predetermined positions of the interrogation cycle, an interrupt request signal to the own master unit.

The object of this invention is to provide a communication system of the multiplex type between a master processing unit and slave units in which each slave unit, although having the simplified structure of a slave unit, can initiate transmission to the master unit so as to overcome the disadvantages mentioned above, with particular advantage in application to the communication system between a plurality of electrical devices in a vehicle, where it is important to have a relatively simplified system, but with a high guarantee of satisfactory performance, in order to reduce production and installation costs.

In accordance with this invention a communication system is provided between at least one master unit and slave units, as defined in claim 1-

In order to provide a better understanding of this invention a particular embodiment will now be described purely by a way of a non-restrictive example with reference to the appended drawings in which:

Figure 1 is a diagrammatical view from above of a motor vehicle to which the communication system for activation and control of a plurality of electrical devices constructed according to this invention is fitted,

Figure 2 is a simplified block diagram of the connections between the various units in the system in Figure 1,

Figure 3 is an illustration of a communication message between units in the system in Figure 1, and

Figure 4 is an illustration of a communication time sequence between units in the system in Figure 1.

The communication system according to this invention between various slave units and a master unit, and therefore between various slave units via a master unit, applies to local transmission networks of the multiplex type, and conveniently to multiplex networks in motor vehicles, for example of the type described in the abovementioned Italian patent application no. 67158-A/89 filed on the 7 March 1989 and corresponding to WO-A-90/10559, the contents of which are incorporated in this description by mere reference where necessary.

Figure 1 therefore illustrates a motor vehicle 1 including actuator devices provided respectively

with slave units connected with a master by means of multiplex connections, forming a communication system according to this invention. This motor vehicle 1 has two front doors 2 and 2', and two rear doors 3 and 3', illustrated in the open position. A main control master unit 5 comprising a microprocessor 6 is housed close to dashboard 4 and from this lead cables 7, 7', 8 and 8' and 9 respectively, each of which consists of a first electrical power supply conductor 10, a second data signal transmission conductor 11 and a third conductor 12 connected to earth.

Cables 7 and 7' go to front doors 2 and 2' respectively, while cables 8 and 8' go to rear doors 3 and 3'. Each of these cables is progressively connected by means of corresponding branches from the three conductors to a corresponding slave unit 27 which is connected respectively to a manual control switch device 14, an electrical control device 15 for an outside rear-view mirror 16, a door locking device 17 and a window winding device 18 for the activation and control thereof. In particular this slave unit 27 conveniently includes a printed circuit to which are connected a first integrated circuit for the distribution of electrical power by means of an activating component (e.g. a small direct current electric motor) of the corresponding device with which slave unit 27 is associated, and a second integrated circuit for the processing of data signals relating to the operation of that component. These first and second integrated circuits form a logic unit and may conveniently include specific logic circuits for a microprocessor, solid state switches, etc., and may form circuits for protection against voltage and current overloads, control and diagnostic circuits, etc.

In the case of device 14 with manual control switches the first integrated circuit is missing, in that there is no power activation, whereas in the case of device 15 for electrical control of the outside rear-view mirror 16 there will be more than one activating member, in that the various electrical components activating orientation movements of the reflecting surface of the rear-view mirror, for altering the orientation of the rear-view mirror body with respect to the door, may be controlled, and a supply may be provided to the components heating the reflecting surface.

In the case of cables 8 and 8' for doors 3 and 3' the connection with electrical control device 15 for outside rear-view mirror 16 will obviously be missing. Cable 8 also passes by means of a branch 26 to a slave unit 27 associated with a device 28, similar to device 17, for locking and releasing a boot 30, while cable 8' passes via a branch 26' to a slave unit 27 associated with a device 28', also similar to device 17, for locking and releasing a flap 31 providing access to a fuel filler cap for motor vehicle 1.

Cable 9 in turn is progressively connected by means of corresponding branches to three conductors, two relating to slave units 27 associated respectively with a first and a second manual control switch device 32 and 33 placed in a zone 34 (console) between the front seats capable of controlling devices 15 for electrical control of outside rear-view mirrors 16 and window winding devices 18.

As is illustrated in greater detail in Figure 2, the main control master unit 5 which is connected to a supply battery 40 is in turn connected to slave units 27 connected for example to cable branch 7 by means of conductor 10 providing a positive electrical power supply, a conductor 11 for the transmission of data signals and a conductor 12 providing a connection to earth. Connection of the various slave units 27 to transmission conductor 11 is of the "wired and" type, in which a return resistor 41 is connected between conductor 11 and positive power conductor 10 in master unit 5, so that the dominant logic level is a "low" logic level, and is subordinate to any of the units which initiates transmission. In both master unit 5 and slave units 27 transmission conductor 11 is in fact connected to the input to corresponding data receipt block 43, while a switch block 44 with a switch which is controlled by a data message transmission block 45 is connected between transmission conductor 11 and earth conductor 12. These blocks 43 and 45 form the logic elements of the unit, and the coding for unit information is therefore of the type in which the duration of pulses of constant amplitude equal to the supply voltage is modulated. Logic value "1" is coded by a high/low ratio of more than unity, and vice versa for logic level "0". The connection structure described with the return resistor, the switch block and the data receipt and transmission blocks are repeated in master unit 5 for the other communication conductors 11, 11', 11"..., for the other cables, and other corresponding members are indicated by the same numbers and indices.

The message sent by any one of units 5 or 27 on transmission conductor 11 has a characteristic time course shown in Figure 3, in which starting from a "high" resting level of conductor 11, at which the transmission line is not occupied, there is a first message start field 50 in which transmission conductor 11 is altered to the "low" level by closing switch block 44 which is controlled by transmission block 45 of the corresponding unit initiating the exchange, then there is a second address field 51 conveniently consisting of six identification bits for the slave unit 27 which is transmitting, the logic level "1" or "0" of which is given by modulation of the closing time for switch

block 44 controlled by block 45, then there is a third data field 52 conveniently consisting of four bits coding the command or message which has been transmitted, and a further check field 53 conveniently consisting of two redundant bits for checking that the message received is correct. Finally the transmission line is released by the transmitting unit and the signal on transmission conductor 11 returns to the "high" resting level.

A command from one of the slave units 27 to another (or several other) slave units 27 is transmitted via master unit 5 through steps which will be described with reference to Figure 4 which shows their temporal sequence.

Assuming for example that at an initial instant 0 a pulse is activated from switch unit 14 on door 2 to cause the window winding device 18 in door 2' to open (Figure 1), initially slave unit 27 (indicated by A) associated with this switch device 14 on door 2 decodes the type of activation made and ascertains that no communication is already in progress on the transmission line by checking the voltage level in transmission conductor 11, which is at the high level when at rest as already described. If the level is high at instant t1 (1 msec) this slave unit 27 (A) transmits via transmission conductor 11 a coded message of the type illustrated in Figure 3 containing its own identification code, the command code and the check field. At instant t2 (8 msec) the coded message is received by master unit 5, which may be "activated" by the first field 50 of this message to return to a fully operative condition from a resting state of low power consumption in which it may be, and this master unit 5 checks that the message received is correct and that the corresponding command can be executed. If this is the case, at instant t3 (9 msec) this master unit 5 transmits a coded message, again of the type illustrated in Figure 3, including the identification code for the slave unit 27 (B), the command code and the check field, along transmission conductor 11' which passes to slave units 27 including the unit 27 (indicated by B in Figure 1) associated with the window winding device 18 on door 2'. At instant t4 (15 msec), the coded message is recognised by that slave unit 27 (B), which checks that the message received is correct, and if this is the case causes the window winding device to be activated. From that instant t4 slave unit 27 (B) controls the occupation of transmission conductor 11' by means of a low logic level signal corresponding to an extension of field 50 in Figure 3 for a sufficient time (t4 - t5, conveniently 3 msec), to allow the disturbances due to the start-up of the actuator control by that unit 27 (B) to dampen down, and then at instant t5 (18 msec) that slave unit 27 (B) transmits a coded message to master unit 5 via transmission conductor 11' containing its own identification code, the code for the status of the actuator controlled by that unit 27 (B), therefore indicating that implementation of the command has been activated, together with any diagnostic information, and the check field. At instant t6 (23 msec) the coded message is received by master unit 5, which checks that the actuation has been correctly activated, at instant t7 (25 msec) it transmits a coded message, again of the type illustrated in Figure 3, comprising the identification code of the slave unit 27 (A) and the code confirming that the actuation command for the selective device of unit 27 (B) has been transmitted (actuation in progress), along transmission conductor 11 which passes to slave units 27 including unit 27 (A) associated with the switch activated by the control device 14. At instant t8 (31 msec) the coded message is recognised by the slave unit 27 (A), and on conclusion of the communication cycle described this can then return to the resting state after confirming that the command has been executed.

In the event of a failure at any level of the chain in the abovementioned communication cycle, unit 27 or 5, which at that time is acting as a transmitter, on failing to receive reply messages or detect any activity on the transmission line, repeats the message for a finite number of times.

The advantages obtained with the communication system according to this invention are obvious from what has been described, in that:

- to begin with the complexity of the transmission protocol and therefore the complexity of the slave units is very much reduced in comparison with a multimaster system. This makes it possible to use a smaller number of components to construct the said slave units (by way of indication 10 to 60 in a local network), which is particularly advantageous for applications in motor vehicles, such as that described, where on account of mass production cost reductions are of major importance, and there is also a useful reduction in size enabling the units to be mounted directly on the various electromechanical devices,
- transmission can be initiated from any slave unit without having to have additional lines to request communication. This is particularly advantageous in applications in motor vehicles, like that described, where there must be a resting state in which overall minimum power consumption is guaranteed in order to avoid discharging the battery. In this state it is not in fact possible to maintain an active master unit operating an interrogation or synchronisation programme as would be necessary with master/slave architecture. In the special application described it is necessary

for example to be able to release all the door locks simultaneously following the manual release of one of these when the system is in the low power consumption state (vehicle parked and completely at rest),

- there is a single master unit in which the programmed logic elements (e.g. the microprocessor) are concentrated. In general this assists the handling of all commands and/or enables for the functioning of various actuators, with resulting simplicity, reliability and flexibility of the system, and the possibility of identifying errors, in addition to the possibility of communicating with other intelligent systems,
- as all messages must be received and transmitted by the master unit (unlike multimaster systems) the latter can operate degraded functioning modes in the event of a local fault, if a particular arrangement is selected for the various communication lines, for example the "star" arrangement illustrated in Figure 1, where a plurality of groups of slave units are connected to corresponding communication lines which are in turn connected to the master unit as described in the Italian patent application 67328 -A/89, filed on the same date by the same applicant and corresponding to EP-A-396089 entitled: "Connection system between a master unit and slave units", the contents of which are incorporated in this description by simple reference where necessary. This may be done without recourse to duplicating the transmission line, which in the specific application of motor vehicles is one of the most frequent causes of a fault.

Other advantages are that:

- the structure of the communication message is extremely simple, with only a single constant identification field 51 for each slave unit 27, functioning as an address or signature for the message which the slave unit must receive or has sent,
- data field 52 is reduced to a minimum (in fact, for example, using only four bits, movement can be controlled in three axes, plus a power actuation for a given actuator, for example that of device 15 which electrically controls outside rear-view mirror 16), as there are no different possible interpretations of the data,
- the structure of such a message makes it possible to activate any one of the units connected to the communication line from a resting condition whenever such a message is initiated, this being determined by the initial low level field 50, and to return to the low power consumption resting condition when the communication line is again free (detected by the high level logic signal for a predetermined time),
- the structure of the communication may be handled simultaneously with communication structured in a different way, for example:
  a) it may coexist with cyclical interrogation (polling) of the slave units by the master unit, merely by authorising the latter to perform this function only after a period of time during which the communication line is free for a period longer than that specified for command transmissions in real time,
  b) the master unit may under certain conditions become transparent, allowing the possibility of direct transmission between slave units,
  c) given the possibility of using a "star" connection arrangement centred on the master unit as described, any non-functioning communication branches can be isolated.

Finally it is clear that modifications and variants may be applied to the embodiment of this invention described and illustrated. For example the number and allocation of the connected devices indicated by way of example may be varied and the circuit configurations which have been illustrated by way of example in the diagrams may also be varied. In addition to this master unit 5 may have connections between the various communication conductors 11, 11', 11'',..., other than those illustrated in Figure 2, with communication interconnections as described in the abovementioned patent application EP-A-396089 entitled: "Connection system between a master unit and slave units".

Claims

1. A communication system between at least one master unit (5) and a plurality of slave units (27), said plurality of slave units being directly connected to said master unit (5) through at least one communication channel (11), said slave units (27) comprising logical means (43, 44, 45) for exchanging communication messages with said master unit and for independently initiating transmission towards said master unit, characterized in that said logical means (43, 44, 45) are able to initiate transmission at any time said communication channel is free.

2. A system according to claim 1, characterised in that the said communication messages exchanged by the said slave units (27) with the said master unit (5) comprise a first field (51) identifying a said slave unit (27) and a second

data field (52).

3. A system according to claim 2, characterised in that the said first field (51) identifies the said slave unit (27) which sent the said communication in the event of transmission towards the master unit (5) and identifies the said slave unit (27) which is to receive the said communication in the case of transmission towards the said slave unit (27).

4. A system according to claim 2 or 3, characterised in that the said second data field (52) includes activation or control data for the said slave unit (27) and/or the said master unit (5).

5. A system according to one of claims 2 to 4, characterised in that the said first field (51) consists of six bits and that the said second field (52) consists of four bits.

6. A system according to one of the foregoing claims, characterised in that the said slave (27) and master (5) units are connected to the said common communication channel (11) by means (41) which force the said channel (11) to a different logical level when the said channel (11) is occupied by one of the said units (27, 5) in order to send a communication message.

7. A system according to claim 6, characterised in that the said units (27, 5) detect that the said channel (11) is in a free condition for the forwarding of a communication message by means (43) for detecting the said logical level of the said channel (11).

8. A system according to one of the foregoing claims, characterised in that the said communication message has a preliminary field (50) which can be used to activate the said units (27, 5) from a resting state of minimum power consumption.

9. A system according to claim 8, deriving from claim 7, characterised in that the said preliminary field (50) produces a different logical level in the said channel (11).

10. A system according to one of the foregoing claims, characterised in that the said logical means include at least one block (43) which detects data signals on the said communication channel (11), and at least one block (45) transmitting data signals on the said channel (11).

11. A system according to one of the foregoing claims, characterised in that the said communication message transmission is effected by means of an asynchronous serial protocol.

12. A system according to claim 11, characterised in that the said transmission is effectuated by constant pulse height duration modulation.

13. A system according to one of the foregoing claims, characterised in that groups of the said slave units (27) are connected to corresponding communication lines (7, 7',...) connected to the said master unit (5).

14. A system according to claim 13 characterised in that the said slave units (27) are some ten in number.

15. A system according to claim 13 or 14, characterised in that the said master unit (5) includes means (6) for controlling the exchange of data signals between the said communication lines (7, 7',...).

16. A system according to one of the foregoing claims, characterised in that the said master unit (5) includes a microprocessor (6).

17. A system according to one of the foregoing claims, characterised in that the said slave units (27) are associated with electrical devices (14, 15, 17, 18, 28, 28', 32, 33) in a vehicle (1) for activating or controlling at least one electrically functioning member in the said device (14, 15, 17, 18, 28, 28', 32, 33).

18. A system according to claim 17, characterised in that a first (27 A) of the said slave units is by means of the said logical means (43, 44, 45) capable of sending the said master unit (5) a first communication message to actuate one (18) of the said devices (14, 15, 17, 18, 28, 28', 32, 33) controlled by a second (27 B) of the said slave units, that the said master unit (5) is capable of sending a second actuation command message for the said second (27 B) of the said slave units, that the said second slave unit (27 B) is capable of sending the said master unit (5) a third message providing information about the said actuation, and that the said master unit (5) is capable of sending the said first slave unit (27 A) a fourth message confirming receipt of the actuation command from the said second slave unit (27 B).

19. A system according to claim 17 or 18, characterised in that the said peripheral units (27)

include at least one integrated circuit providing means for the distribution of electrical power for operation of the said component, and/or means for the treatment of data signals relating to the functioning of the said component.

20. A system according to one of the foregoing claims, characterised in that the said communication channel between the said slave units (27) and the said master unit (5) is provided by means of at least one electrical connection cable (7, 7', 8, 8', 9) comprising a first conductor (10) with a positive electrical power supply, a second conductor (11) for the transmission of data signals and a third conductor (12) which is connected to earth.

21. A system according to claim 20, characterised in that it includes a single said electrical connection cable (7, 7', 8, 8') for at least the devices (14, 15, 17, 18) applied to one door (2, 2', 3, 3') of a vehicle (1).

22. A system according to claim 21, characterised in that the said devices applied to the said door (2, 2', 3, 3') include at least one window winding device (18), a door locking device (17) and a manual control switch device (14).

23. A system according to claim 22, characterised in that the said devices applied to the said door (2, 2') also include a device (15) for electrical control of an outside rear-view mirror (16).

24. A motor vehicle (1) including a plurality of devices (14, 15, 17, 18, 28, 28', 32, 33) comprising at least one electrically functioning member, characterised in that it includes a communications system between at least one master processing unit (5) and slave units (27) associated with the said devices (14, 15, 17, 18, 28, 28', 32, 33) according to one of the foregoing claims.

Patentansprüche

1. Kommunikationssystem zwischen wenigstens einer führenden Einheit (5) und einer Mehrzahl von geführten Einheiten (27), die direkt mit der führenden Einheit (5) über wenigstens einen Kommunikationskanal (11) verbunden sind und die logische Einrichtungen (43, 44, 45) zum Austausch von Kommunikationsnachrichten mit der führenden Einheit und zum unabhängigen Initiieren von Übertragungen zur führenden Einheit umfassen, dadurch gekennzeichnet, daß die logischen Einrichtungen (43,44, 45) Übertragungen zu jeder Zeit, zu der der Kommunikationskanal frei ist, initiieren können.

2. System nach Anspruch 1, dadurch gekennzeichnet, daß die von den geführten Einheiten (27) mit der führenden Einheit (5) ausgetauschten Kommunikationsnachrichten ein erstes Feld (51) umfassen, das die geführte Einheit (27) identifiziert und ein zweites, nämlich ein Datenfeld (52) umfassen.

3. System nach Anspruch 2, dadurch gekennzeichnet, daß das erste Feld (51) im Fall des Sendens zur führenden Einheit (5) die geführte Einheit (27) identifiziert, die die Kommunikation gesendet hat, und im Fall des Sendens zur geführten Einheit (27) die geführte Einheit (27) identifiziert, die die Kommunikation empfangen soll.

4. System nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß das zweite, nämlich das Datenfeld (52) Aktivierungs- oder Steuerdaten für die geführte Einheit (27) und/oder für die führende Einheit (5) enthält.

5. System nach einem der Ansprüche 2 bis 4, dadurch gekennzeichnet, daß das erste Feld (51) aus sechs Bits besteht und das zweite Feld (52) aus vier Bits besteht.

6. System nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die geführten (27) und die führenden (5) Einheiten mit dem gemeinsamen Übertragungskanal (11) durch Einrichtungen (41) verbunden sind, die diesen Kanal (11) dann auf einen anderen logischen Wert setzen, wenn dieser Kanal (11) durch eine der Einheiten (27, 5) zum Zweck des Sendens einer Kommunikationsnachricht belegt wird.

7. System nach Anspruch 6, dadurch gekennzeichnet, daß die Einheiten (27, 5) mit Hilfe einer Einrichtung (43) zum Feststellen des logischen Werts des Kanals (11) feststellen, daß der Kanal (11) sich in einem für das Abgeben einer Kommunikationsnachricht freien Zustand befindet.

8. System nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Kommunikationsnachricht ein vorlaufendes Feld (50) aufweist, das zum Aktivieren der Einheiten (27, 5) aus einem Ruhezustand minimalen Stromverbrauchs heraus verwendet werden kann.

9. System nach dem auf Anspruch 7 rückbezogenen Anspruch 8, dadurch gekennzeichnet, daß das vorlaufende Feld (50) im Kanal (11) einen anderen logischen Wert erzeugt.

10. System nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die logischen Einrichtungen wenigstens einen Block (43) enthalten, der Datensignale auf dem Kommunikationskanal (11) entdeckt, und wenigstens einen Block (45) enthalten, der Datensignale auf diesem Kanal (11) sendet.

11. System nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das Senden der Kommunikationsnachricht mit Hilfe eines asynchronen Serienprotokolls bewirkt wird.

12. System nach Anspruch 11, dadurch gekennzeichnet, daß das Senden bewirkt wird durch eine Impulsdauermodulation bei konstanter Impulshöhe.

13. System nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß Gruppen der geführten Einheiten (27) mit entsprechenden mit der führenden Einheit (5) verbundenen Kommunikationsleitungen (7,7',...) verbunden sind.

14. System nach Anspruch 13, dadurch gekennzeichnet, daß es einige zehn geführte Einheiten (27) gibt.

15. System nach Anspruch 13 oder 14, dadurch gekennzeichnet, daß die führende Einheit (5) eine Einheit (6) zum Steuern des Austauschs von Datensignalen zwischen den Kommunikationsleitungen (7,7',...) enthält.

16. System nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die führende Einheit (5) einen Mikroprozessor (6) enthält.

17. System nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die geführten Einheiten (27) elektrischen Vorrichtungen (14, 15, 17, 18, 28, 28', 32, 33) in einem Fahrzeug (1) zum Aktivieren oder Steuern von wenigstens einem elektrisch funktionierenden Bauteil in dieser Vorrichtung (14, 15, 17, 18, 28, 28', 32, 33) zugeordnet sind.

18. System nach Anspruch 17, dadurch gekennzeichnet, daß eine erste (27 A) der geführten Einheiten mit Hilfe der logischen Einrichtungen (43, 44, 45) der führenden Einheit (5) eine erste Kommunikationsnachricht zum Betätigen einer (18) dieser Vorrichtungen (14, 15, 17, 18, 28, 28', 32, 33) senden kann, die von einer zweiten (27 B) der geführten Einheiten gesteuert werden daß die führende Einheit (5) eine zweite Nachricht, nämlich eine Betätigungsbefehlsnachricht für diese zweite (27 B) der geführten Einheiten senden kann, daß diese zweite geführte Einheit (27 B) der führenden Einheit (5) eine dritte Nachricht senden kann, die eine Information über die Betätigung gibt, und daß die führende Einheit (5) an die erste geführte Einheit (27 A) eine vierte Nachricht senden kann, die den Empfang des Betätigungsbefehls von der zweiten geführten Einheit (27 B) bestätigt.

19. System nach Anspruch 17 oder 18, dadurch gekennzeichnet, daß die peripheren Einheiten (27) wenigstens einen integrierten Schaltkreis, der Einrichtungen für die Verteilung von elektrischer Leistung für den Betrieb dieses Bauteils zur Verfügung stellt, und/oder Einrichtungen für die Behandlung von Datensignalen, die sich auf die Funktion dieses Bauteils beziehen, enthalten.

20. System nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Kommunikationskanal zwischen den geführten Einheiten (27) und der führenden Einheit (5) durch wenigstens ein elektrisches Verbindungskabel (7, 7', 8, 8', 9) geschaffen ist das einen ersten Leiter (10) mit einer positiven elektrischen Stromversorgung, einen zweiten Leiter (11) für die Übertragung von Datensignalen und einen dritten Leiter (12) der mit Masse verbunden ist, umfaßt.

21. System nach Anspruch 20, dadurch gekennzeichnet, daß es ein einziges elektrisches Verbindungskabel (7, 7', 8, 8') für wenigstens die für eine der Türen (2, 2', 3, 3') eines Fahrzeugs (1) verwendeten Vorrichtungen (14, 15, 17, 18) enthält.

22. System nach Anspruch 21, dadurch gekennzeichnet, daß die für diese Türe (2, 2', 3, 3') verwendeten Vorrichtungen wenigstens eine Fenster-Auf-und-Zudrehvorrichtung (18), eine Türverriegelvorrichtung (17) und eine manuelle Steuerschaltervorrichtung (14) umfassen.

23. System nach Anspruch 22, dadurch gekennzeichnet, daß die für die Türe (2, 2') verwendeten Vorrichtungen außerdem eine Vorrichtung (15) für die elektrische Steuerung eines Außen-

rückblickspiegels (16) umfassen.

24. Kraftfahrzeug (1) mit einer Vielzahl von Vorrichtungen (14, 15, 17, 18, 28, 28', 32, 33), die wenigstens ein elektrisch funktionierendes Bauteil enthalten, dadurch gekennzeichnet, daß es ein Kommunikationssystem zwischen wenigstens einer führenden Verarbeitungseinheit (5) und geführten Einheiten (27), denen diese Vorrichtungen (14, 15, 17, 18, 28, 28', 32, 33) zugeordnet sind, gemäß einem der vorhergehenden Ansprüche enthält.

Revendications

1. Système de communication entre au moins un module maître (5) et une pluralité de modules esclaves (27), les modules esclaves étant directement connectés au module maître (5) par l'intermédiaire d'au moins un canal de communication (11), les modules esclaves (27) comprenant des moyens logiques (43, 44, 45) pour échanger des messages de communication avec le module maître et pour initialiser de façon indépendante une émission vers le module maître, caractérisé en ce que lesdits moyens logiques (43, 44, 45) peuvent initialiser une transmission à tout instant où le canal de communication est libre.

2. Système selon la revendication 1, caractérisé en ce que les messages de communication échangés entre les modules esclaves (27) et le module maître (5) comprennent un premier champ (51) identifiant un module esclave (27) et un second champ de données (52).

3. Système selon la revendication 2, caractérisé en ce que le premier champ (51) identifie le module esclave (27) qui a envoyé la communication dans le cas d'une émission vers le module maître (5) et identifie le module esclave (27) qui doit recevoir la communication dans le cas d'une émission vers le module esclave (27).

4. Système selon la revendication 2 ou 3, caractérisé en ce que le second champ de données (52) comprend des données d'activation ou de commande pour le module esclave (27) et/ou le module maître (5).

5. Système selon l'une des revendications 2 à 4, caractérisé en ce que le premier champ (51) comprend six bits et en ce que le second champ (52) comprend quatre bits.

6. Système selon l'une des revendications précédentes, caractérisé en ce que les modules esclaves (27) et maître (5) sont reliés au canal de communication commun (11) par des moyens (41) qui forcent le canal (11) à un niveau logique différent quand le canal (11) est occupé par l'un des modules (27, 5) pour envoyer un message de communication.

7. Système selon la revendication 6, caractérisé en ce que les modules (27, 5) détectent que le canal (11) est dans un état libre pour l'envoi d'un message de communication par des moyens (43) de détection du niveau logique du canal (11).

8. Système selon l'une des revendications précédentes, caractérisé en ce que le message de communication comprend un champ préliminaire (50) qui peut être utilisé pour activer lesdits modules (27, 5) à partir d'un état de veille à consommation minimale.

9. Système selon la revendication 8, prise dans sa dépendance de la revendication 7, caractérisé en ce que le champ préliminaire (50) produit un niveau logique différent dans le canal (11).

10. Système selon l'une des revendications précédentes, caractérisé en ce que les moyens logiques comprennent au moins un bloc (43) qui détecte des signaux de données sur le canal de communication (11), et au moins un bloc (45) émettant des signaux de données sur le canal (11).

11. Système selon l'une des revendications précédentes, caractérisé en ce que l'émission du message de communication est réalisée selon un protocole série asynchrone.

12. Système selon la revendication 11, caractérisé en ce que l'émission est effectuée par une modulation de durée d'impulsions de hauteur constante.

13. Système selon l'une des revendications précédentes, caractérisé en ce que des groupes de modules eslaves (27) sont connectés à des lignes de communication correspondantes (7, 7',....) connectées au module maître (5).

14. Système selon la revendication 13, caractérisé en ce que les modules esclaves (27) sont au nombre de quelques dizaines.

15. Système selon la revendication 13 ou 14, caractérisé en ce que le module maître (5) comprend des moyens (6) pour contrôler les échanges de signaux de données entre les lignes de communication (7, 7',...).

16. Système selon l'une des revendications précédentes, caractérisé en ce que le module maître (5) comprend un microprocesseur (6).

17. Système selon l'une des revendications précédentes, caractérisé en ce que les modules esclaves (27) sont associés à des dispositifs électriques (14, 15, 17, 18, 28, 28', 32, 33) d'un véhicule (1) pour activer ou commander au moins un élément à fonctionnement électrique dans un dispositif (14, 15, 17, 18, 28, 28', 32, 33).

18. Système selon la revendication 17, caractérisé en ce qu'un premier (27A) des modules esclaves peut, par l'intermédiaire des moyens logiques (43, 44, 45), envoyer au module maître (5) un premier message de communication pour actionner l'un (18) desdits dispositifs (14, 15, 17, 18, 28, 28', 32, 33) commandés par un second (27B) des modules esclaves, en ce que le module maître (5) peut envoyer un second message de commande d'actionnement pour le second (27B) des modules esclaves, en ce que le second module esclave (27B) peut envoyer au module maître (5) un troisième message fournissant des informations sur ledit actionnement, et en ce que le module maître (5) peut envoyer au premier module esclave (27A) un quatrième message confirmant la réception de l'ordre d'actionnement à partir du second module esclave (27B).

19. Système selon la revendication 17 ou 18, caractérisé en ce que les modules périphériques (27) comprennent au moins un circuit intégré fournissant des moyens pour la distribution d'énergie électrique pour l'actionnement du composant, et/ou des moyens pour le traitement des signaux de données concernant le fonctionnement du composant.

20. Système selon l'une des revendications précédentes, caractérisé en ce que le canal de communication entre les modules esclaves (27) et le module maître (5) est assuré par au moins un câble de connexion électrique (7, 7', 8, 8', 9) comprenant un premier conducteur (10) lié à une alimentation électrique positive, un second conducteur (11) pour la transmission des signaux de données, et un troisième conducteur (12) connecté à la masse.

21. Système selon la revendication 20, caractérisé en ce qu'il comprend un seul dit câble de connexion électrique (7, 7', 8, 8') pour au moins les dispositifs (14, 15, 17, 18) associés à une porte (2, 2', 3, 3') d'un véhicule (1).

22. Système selon la revendication 21, caractérisé en ce que les dispositifs appliqués à ladite porte (2, 2', 3, 3') comprennent au moins un dispositif lève-vitre (18), un dispositif de verrouillage de porte (17) et un dispositif commutateur de commande manuelle (14).

23. Système selon la revendication 22, caractérisé en ce que les dispositifs appliqués à la porte (2, 2') comprennent également un dispositif (15) pour commander électriquement un rétroviseur externe (16).

24. Véhicule à moteur (1) comprenant une pluralité de dispositifs (14, 15, 17, 18, 28, 28', 32, 33) comportant au moins un élément fonctionnant électriquement, caractérisé en ce qu'il comprend un système de communication entre au moins un module de traitement maître (5) et des modules esclaves (27) associés aux dispositifs (14, 15, 17, 18, 28, 28', 32, 33) selon l'une des revendications précédentes.

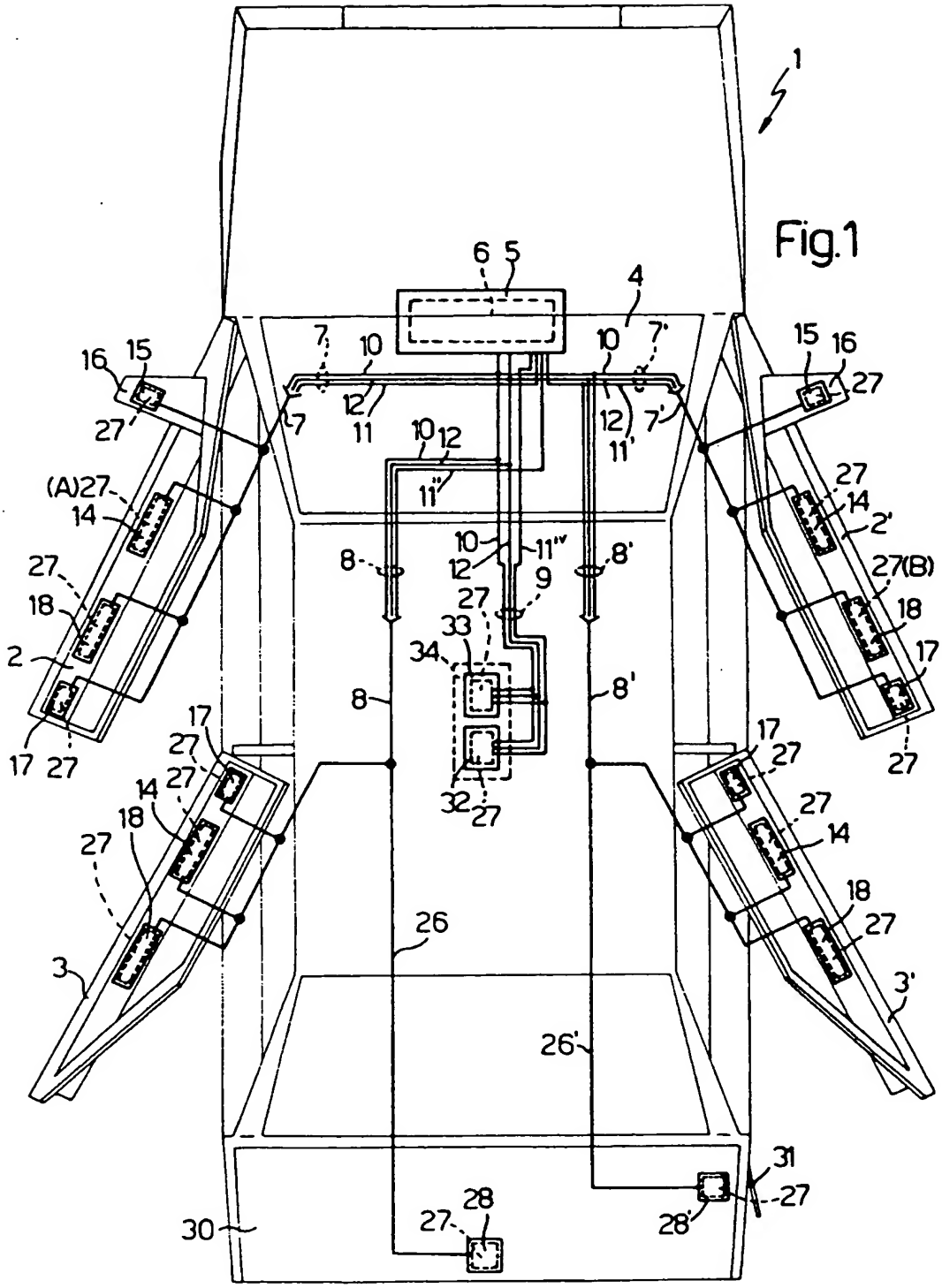
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Fig.1

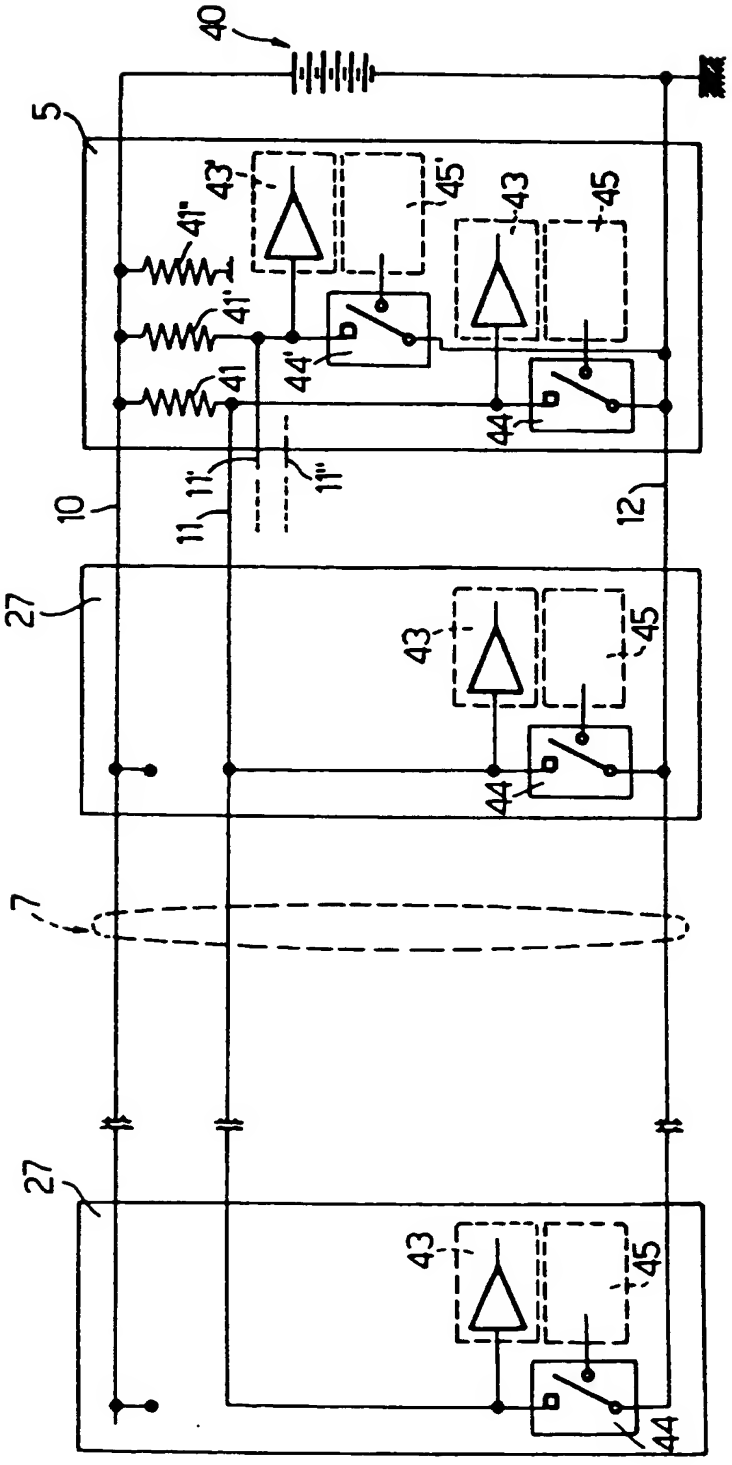

Fig.2

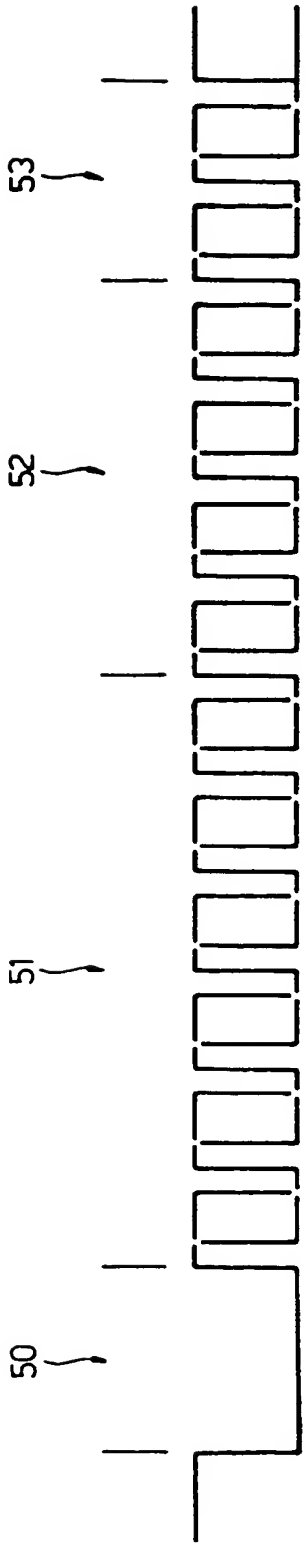

Fig.3

Fig.4